भारतीय मानक

Indian Standard

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वाणिज्यिक रसोई में अग्नि सुरक्षा — दिशानिर्देश

Fire Safety in Commercial Kitchen — Guidelines

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FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Fire Safety Sectional Committee had been approved by the Civil Engineering Division Council.

With the growing business and economic activity in the country, and to cater to the human needs, increased cooking activity through large number of commercial kitchens such as hotels, food courts, malls, banquet halls, restaurants, *langars,* etc is witnessed. From the erstwhile, fuel options which mainly included wood, kerosene, the options now include LPG, CNG, electric based, oil/deep fat fryers, etc. Other associated electromechanical appliances are commonly housed in or next to such kitchen. Deployment of ducts, chimneys, or other mechanical exhaust systems on the one hand helped in maintaining the ambience but ignoring their upkeep or disuse of the same have resulted in untoward fire accidents. Not all such establishments have adequate fire safety inbuilt in them. Based on all such reported fire incidences in such kitchen, some fire protection provisions related to commercial kitchen were introduced in the National Building Code of India 2016 (NBC 2016) in its Annex G under Part 4 'Fire and life safety'.

This standard addresses and provides further detailed provisions towards ensuring fire safety in such kitchen. This standard is formulated with a view to supplement the provisions given in NBC 2016, and to comprehensively cover various aspects of commercial kitchen with regard to fire and life safety. Informatory Annexes (B and C) regarding detection types and actuation units in kitchen hood and test procedure for fixed extinguishing systems in kitchen have been included for reference.

The considerable assistance was derived from the following documents while drafting this standard:

> NFPA 96, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations, National Fire Protection Association, USA, 2017
>
> UL 300, Standard for Fire Testing of Fire Extinguishing Systems for Protection of Commercial Cooking Equipment, Underwriters Laboratories, USA, 2019
>
> Loss Prevention Standard LPS 1223, Requirements and Testing Procedures for the LPCB Certification and Listing of Fixed Fire Extinguishing Systems for Catering Equipment, BRE Global Ltd, 2014
>
> IHG Group Hotel's Safety Manual, Inter-Continental Hotels Group PLC

This standard relates to the SDG 9 (industry, innovation, and infrastructure) and SDG 11 (sustainable cities and communities) as it provides guidelines for ensuring that the infrastructure is safe and reliable.

The composition of the Committee responsible for formulation of the standard is given in Annex D.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS 2 : 2022 'Rules for rounding off numerical values (*second revision*)'. The number of significant places retained in the rounded off value should be the same as that of specified value in this standard.

Indian Standard

FIRE SAFETY IN COMMERCIAL KITCHEN — GUIDELINES

1 SCOPE

1.1 This standard covers the types of fire hazard and fire-related hazard posed by the kitchen area which is equipped with commercial cooking facilities and equipment.

1.2 It also covers the fire safety requirements to be maintained in the kitchen areas to avoid damage and loss of property.

1.3 This standard is applicable to those commercial kitchens serving in centrally air-conditioned buildings such as kitchens of starred hotels, food courts, malls, banquet halls and restaurants. It is strongly advised that other types of kitchens in non-air-conditioned buildings should also suitably utilize the provisions of this standard with further supplementary material.

2 REFERENCES

The standards listed in Annex A contain provisions, which through reference in this text, constitute provisions of this standard. At the time of publication, the edition indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of standards.

3 TERMINOLOGY

For the purpose of this standard, the terms given below and those in IS 8757 shall apply.

3.1 Access Door — A door providing access into ducts for maintenance or inspection.

3.2 Access Panel — A closure device used to cover an opening into a duct, an enclosure, an equipment, or an appurtenance.

3.3 Air Intakes — An opening in a building's envelope whose purpose is to allow outside air to be drawn into the structure to replace inside air that is removed by exhaust systems or to improve the quality of the inside air by providing a source of air having a lower concentration of odours, suspended particles, or heating content.

3.4 Air Pollution Control Devices — Equipment and devices used for the purpose of cleaning air passing through them or by them in such a manner as to reduce or remove the impurities contained therein.

3.5 Appliance Flue Outlet — The opening or openings in a cooking device where vapours, combustion gases, or both leave the cooking device.

3.6 Appurtenance — An accessory or a subordinate part that enables the primary device to perform or improves its intended function.

3.7 Assembly Occupancy — A building occupancy or a part of it, where number of persons not less than 50 congregate or gather for amusement, recreation, social, religious, patriotic, civil, travel and similar purposes, for example, theatres; motion picture houses; assembly halls; auditoria; exhibition halls; museums; skating rinks; gymnasiums; restaurants; places of worship; dance halls; club rooms; passenger stations and terminals of air, surface and marine public transportation services; and stadia.

3.8 Automatic — Performing a function without the necessity of human intervention.

3.9 Baffle Plate — An object placed in or near an appliance to change the direction, or to retard the flow of air, air–fuel mixtures, or flue gases.

3.10 Class F Fires — Fires in cooking appliances involving cooking fats and oils.

3.11 Clean(ing) — For kitchen exhaust systems and cooking equipment, the act of removing grease, oil deposits, and other residues.

3.12 Cleaning Schedule — A document containing information on how and when cleaning is carried out and what equipment and chemicals are used.

3.13 Cooking Appliance/Equipment — A cooking device that has or is capable of having a surface of liquid grease or one in which grease is involved, such as a deep fat fryer, griddle, range, chain broiler, electric char-broiler, charcoal broiler, mesquite broiler, gas-radiant char-broiler, wok, tilt skillets, and similar appliances. The protected area is limited to the cooking surfaces of the appliance only.

3.14 Cylinder/Valve Assembly — A container that incorporates a valve and that provides storage of the extinguishing agent and expellant gas until the valve is actuated. For cartridge operated units, this assembly includes the extinguishing agent storage container and cartridge mechanism. When actuated, the valve releases the agent into the distribution network of the extinguishing system.

3.15 Damper — A valve or plate for controlling draft or flow of gases, including air.

3.16 Detection Devices — Electrical, pneumatic, thermal, mechanical, or optical sensing instruments, or subcomponents of such instruments, whose purpose is to cause an automatic action upon the occurrence of some preselected event.

3.17 Detergent — Substance which on its own or in combination with others, in water, assists cleaning.

3.18 Dips — Depression or cuplike places in horizontal duct runs in which liquids could accumulate.

3.19 Discharge — The final portion of a duct or pipe where the product being conveyed is emptied or released from confinement; the termination point of the pipe or duct.

3.20 Discharge Rate — The ratio of the quantity of agent discharged from a nozzle to the discharge time measured within ± 1 s. When a minimum discharge rate is indicated, reference is made to the minimum quantity of agent discharged and the time measured within ± 1 s.

3.21 Duct Termination — The final or intended end-portion of a duct system that is designed and functions to fulfil the obligations of the system in a satisfactory manner.

3.22 Ducts (or Duct System) — A continuous passageway for the transmission of air and vapours that, in addition to the containment components themselves, might include duct fittings, dampers, plenums, and/or other items or air-handling equipment.

3.22.1 *Bleed Air Duct* — An intake duct in a manifold duct system, designed to input air to maintain system balance.

3.22.2 *Grease Duct* — A containment system for the transportation of air and grease vapours that is designed and installed to reduce the possibility of the accumulation of combustible condensation and the occurrence of damage if a fire occurs within the system.

3.23 Easily Accessible — Within comfortable reach, with limited dependence on mechanical devices, extensions, or assistance.

3.24 Enclosure

3.24.1 *Continuous Enclosure* — A recognized architectural or mechanical component of a building having a fire resistance rating as required for the structure and whose purpose is to enclose the vapour removal duct for its full length to its termination point outside the structure without any portion of the enclosure having a fire resistance rating less than the required value.

3.24.2 *Grease Duct Enclosure*

3.24.2.1 *Factory-built grease duct enclosure* — A certified factory-built grease duct system evaluated as an enclosure system for reduced clearances to combustibles and as an alternative to a duct with its fire-rated enclosure.

3.24.2.2 *Field-applied grease duct enclosure* — A certified system evaluated for reduced clearances to combustibles and as an alternative to a duct with its fire-rated enclosure.

3.25 Equipment

3.25.1 *Fire-Extinguishing Equipment* — Automatic fire-extinguishing systems and portable fire extinguishers provided for the protection of grease removal devices, hoods, duct systems, and cooking equipment, and certified for such use.

3.25.2 *Solid Fuel Cooking Equipment* — Cooking equipment that utilizes solid fuel.

3.26 Extract Plenum — The space in the canopy normally after the grease filters but before the duct.

3.27 Extract Ventilation — Ventilation by which the air is discharged to atmosphere.

3.28 Filter

3.28.1 *Grease Filter* — A removable component of the grease removal system designed to capture grease and direct it to a safe collection point.

3.28.2 *Mesh Filter* — A filter construction consisting of a net made from intersecting strands with a space between each strand.

3.29 Fire Resistance Rating — The time, in minutes or hours, that materials or construction will withstand the standard fire exposure as accordance with standard methods of fire test of materials/ structures.

3.30 Fire Suppression System — An active system which operates to detect and suppress a fire.

3.31 Flash Point — The lowest temperature at which a liquid gives off sufficient flammable vapour in air to produce sustained combustion after the removal of the ignition source.

3.32 Fire Wall — A wall separating buildings or subdividing a building to prevent the spread of the fire and having a fire resistance rating and structural stability.

3.33 Fume Incinerators — Devices utilizing intense heat or fire to break down and/or oxidize vapours and odours contained in gases or air being exhausted into the atmosphere.

3.34 Fusible Link — A form of fixed temperature heat-detecting device sometimes employed to restrain the operation of an electrical or mechanical control until its designed temperature is reached.

3.35 Grease — The residue of by-products from cooking. A variable mix of animal fats/oils, vegetable oils, water vapour, ash, carbon, dust, flour, and other particles.

3.36 Grease Removal Devices — A system of components designed and intended to process vapours, gases, and/or air as it is drawn through such devices by collecting the airborne grease particles and concentrating them for further action at some future time, leaving the exiting air with a lower amount of combustible matter.

3.37 Greasetight — Constructed and performing in such a manner as not to permit the passage of any grease under normal cooking conditions.

3.38 Hazard — Substances, equipment, or methods of work with the potential to cause harm, such as death, injury, property damage and/or business interruption.

3.39 High Limit Control Device — An operating device installed and serving as an integral component of a deep fat fryer that provides secondary limitation of the grease temperature by automatically disconnecting the thermal energy input when the temperature limit is exceeded.

3.40 Hood — A device provided for a cooking appliance(s) to direct and capture grease-laden vapours and exhaust gases.

3.40.1 *Fixed Baffle Hood* — A certified unitary exhaust hood design where the grease removal device is a non-removable assembly that contains an integral fire-activated water-wash fire-extinguishing system certified for this purpose.

3.41 Interconnected — Mutually assembled to another component in such a manner that the operation of one directly affects the other or that the contents of one specific duct system are allowed to encounter or contact the products being moved by another duct system.

3.42 Liquid Tight — Constructed and performing in such a manner as not to permit the passage of any liquid at any temperature.

3.43 Maintenance — Work, including, but not limited to, repair, replacement, and service, performed to ensure that equipment operates properly.

3.44 Plenum — The volume of enclosed space between the grease filters and the portion of the hood above the grease filters in a hood and duct system.

3.45 Qualified — A competent and capable person or company that has met the requirements and training for a given field acceptable to the authority having jurisdiction.

3.46 Recirculating Systems — Systems for control of smoke or grease-laden vapours from commercial cooking equipment that do not exhaust to the outside.

3.47 Removable — Capable of being transferred to another location with a limited application of effort and tools.

3.48 Replacement Air — Air deliberately brought into the structure, then specifically to the vicinity of either a combustion process or a mechanically or thermally forced exhausting device, to compensate for the vapour and/or gases being consumed or expelled.

3.49 Single Hazard Area — Where two or more hazards can be simultaneously involved in fire by reason of their proximity, as determined by the authority having jurisdiction.

3.50 Solid Cooking Fuel — Any solid, organic, consumable fuel such as briquettes, mesquite, hardwood, or charcoal.

3.51 Solvent — A substance capable of dissolving or dispersing another substance; a chemical compound designed and used to convert solidified grease into a liquid or semiliquid state in order to facilitate a cleaning operation.

3.52 Space

3.52.1 *Concealed Spaces* — That portion(s) of a building behind walls, over suspended ceilings, in pipe chases, attics, and whose size might normally range from 50 mm, stud spaces to 2.5 m and that might contain combustible materials such as building structural members, thermal and/or electrical insulation, and ducting.

3.52.2 *Confined Space* — A space whose volume is less than 1.5 m^3 of the aggregate input rating of all appliances installed in that space.

3.53 Spark Arrester — A device or method that minimizes the passage of airborne sparks and embers into a plenum, duct, and flue.

3.55 Thermal Recovery Unit — A device or series of devices whose purpose is to reclaim only the heat content of air, vapours, gases, or fluids that are being expelled through the exhaust system and to transfer the thermal energy so reclaimed to a location whereby a useful purpose can be served.

3.55 Trap — A cuplike or U-shaped configuration located on the inside of a duct system component where liquids can accumulate.

4 HAZARDS AND SAFETY REQUIREMENTS FOR COOKING EQUIPMENT

4.1 General

4.1.1 Cooking equipment used in processes producing smoke or grease laden vapours shall be equipped with an exhaust system that complies with all the equipment and performance requirements of this standard.

NOTES

1 Cooking equipment if certified by recognized agencies with regard to reduced emissions as per requirements need not be required to be provided with an exhaust system subject to approval of authorities concerned.

2 The evaluation of cooking equipment covered by **4.6.1** shall demonstrate that the grease discharge at the exhaust duct of a test hood placed over the appliance shall not exceed 5 mg/m^3 when operated with a total airflow of 0.236 m^3/s.

4.1.2 All such equipment and their performance shall be maintained in accordance with the requirements of this standard during all periods of operation of the cooking equipment.

4.1.3 The following equipment shall be always maintained in expected working condition:

a) Cooking equipment;
b) Hoods;
c) Exhaust ducts;
d) Fans;
e) Fire extinguishing equipment;
f) Fire detection and alarm systems;
g) Gas leakage detectors; and
h) Special effluent or energy control equipment.

4.1.4 Preventive and breakdown maintenance shall be performed on all equipment and their components at intervals necessary to maintain them in expected working condition.

4.1.5 Continuous airflows shall be maintained.

4.1.6 Either the user or the supplier shall be responsible (as per contract) for inspection, testing, maintenance, and cleanliness of the ventilation control and fire protection of the commercial cooking operations. In case of multi-tenanted premises, similar contract shall be available between the owner and the respective tenants.

4.1.7 All interior surfaces of the exhaust system shall be accessible for cleaning and inspection purposes.

4.2 Potential Hazards

4.2.1 The potential hazards posed by the commercial cooking facilities are given below:

a) Electricity, gas and in some cases solid fuels such as wood or charcoal are the energy sources used to power a commercial kitchen;
b) On cooking appliances using grease, the grease can self-ignite due to overheating of the cooking appliances or through open flames;
c) Any combustible like clothing, cooking materials, oils etc when if they come into contact with open flames;
d) Full grease residues trapped in the exhaust ventilation system can ignite through overheated air flues or open flames;
e) Poor housekeeping results in quick spread of fire in dirty and cluttered walkways and storage areas. Also, poor cleaning of the ventilation system provides ground for the fire spreading into the ventilation system and further into the building structure;
f) Faulty electrical equipment and electrical installation are more likely to spark, failure of thermostat and safety switches that may lead to overheat and consequent fire; and
g) Flammable materials in the vicinity of open flames or heat sources.

4.3 Fire Hazards in Cooking Appliances

4.3.1 Fires are common in restaurants and typically start in the kitchen area. Cooking materials are the most frequent ‘first item’ ignited. Experience shows that the majority of kitchen fires will involve the kitchen exhaust hood or ductwork.

4.3.2 Kitchen exhaust fires can spread in a number of ways. A fire that originates within the kitchen or at the hood filters can spread into and up the ductwork system, fuelled by the oil and grease within the duct. A fire within the duct can ignite combustible materials outside of the duct, via radiant heat transmission, or can ignite grease that has leaked out of duct seams, spreading the fire in the building. Because fire dampers are not allowed within kitchen exhaust ductwork, fire spread within and between ducts can compromise a building’s passive fire protection such as fire-rated compartments.

4.3.3 Fire-related hazards in a kitchen include:

a) Flames, sparks, and hot gases from food preparation can ignite residues in exhaust ducts;
b) Food preparation equipment left without supervision during operation;
c) Failure to switch-off equipment, especially at the end of activity;
d) Overheated oils that can lead to spontaneous ignition;
e) Food preparation equipment based on solid fuels;
f) Gas blowtorches used for browning some foods;
g) Poorly operating thermostats or lack of thermostat or fault-detecting equipment;
h) Faulty or overheating electrical equipment;
j) Metal exhaust flues that conduct heat and ignite nearby material or debris;
k) Ovens without igniters/pilot lights (lit with burning pieces of paper);
m) Cooking equipment left unattended during operation;

n) Individual equipment not switched off, especially at the end of a cooking session;

p) Poor maintenance of all equipment and systems;

q) Overheated oils, leading to spontaneous ignition;

r) Fan-motor failure or overheating caused by hardened grease when restarting in seasonal catering establishments, or non 24 hour operations;

s) Thermostats not working correctly and/or the absence of a second, high-level safety thermostat;

t) Metal extract ducts are good conductors of heat and can ignite adjacent materials or litter;

u) Catalytic converters decompose grease but operating at 1 000 °C are a potential source of ignition;

v) Solid fuel cooking equipment (such as barbecues, charcoal grills);

w) The use of burning pieces of paper to light *tandoori* ovens; and

y) Absence of flame failure or safety shut-off device in appliances.

4.3.4 *Fire Hazards and Grease Deposits*

4.3.4.1 Different cooking styles will create different grease residues as given below:

a) Certain types of cooking create a very sticky, syrup-like grease that can become firmly attached to metal surfaces. The surface tension cannot be broken by normal scraping or with general purpose cleaning chemicals;

b) Solid fuel cooked/charbroiled meat creates large quantities of grease. A first layer of grease will bond to metal surfaces and then additional layers of thick, heavy black carbon will build up, containing ash and grease from the cooking process;

c) Deep frying creates a grease similar to translucent creosote; and

d) Frozen foods containing large quantities of water create a hard shiny layer of grease.

4.3.4.2 There is no difference in the hazard posed by different types of cooking oil or fat although the following should be noted:

a) Safe cooking with oils and fats is usually at temperatures below 200 °C. Flammable vapours are given off at 200 °C/300 °C and spontaneous ignition occurs at 310 °C to 360 °C;

b) The flashpoint of cooking oil is reduced by progressive oxidation through repeated use;

c) Deposits of some mixtures, such as chicken fat and vegetable oil, ignite quite readily;

d) Identified hazards to be reduced by:

    1) Minimizing the build-up of grease deposits within the kitchen extract ventilation;

    2) Reducing the risk of spreading fire;

    3) Reducing the growth of bacteria and odour;

    4) Improving airflow through the kitchen; and

    5) Reducing fire hazards which will avoid the associated business loss and liabilities in the event of a fire.

4.4 Ignition Hazards in Cooking Appliances

4.4.1 Many cooking appliances represent a potential source of ignition. Such appliances include as fired equipment with an immediate source of flame, deep fat frying apparatus, and also electric appliances such as toasters, fryers and griddles.

4.4.2 Fuel is available in various forms including:

a) Oil/fat and food products;

b) Combustible materials adjacent to exhaust ducts; and

c) The power supply to the apparatus for example, gas supply.

4.4.3 Air is supplied in large quantities by the inlets of the ventilation system and extract ducts can act as chimneys, increasing the intensity of any fire.

4.5 Additional Hazard Factors

The following additional hazard factors add to the vulnerabilities of kitchens:

a) Combustible food debris trapped in the grease filter;

b) Design aspects of the extract ventilation, such as length of ducts, length of horizontal ducts, type of fan, and number of duct access panels;

c) Remnants of paper napkins or other combustible waste oddments which may have been inadvertently left in cooker hoods or inside the extract ducting etc;

d) Insufficient number of access doors in ductwork to permit effective inspection and cleaning;

e) Extract ducts are often completely inaccessible, for example in older buildings some duct systems may be routed inside masonry chimney breasts;

- f) Grease filters left out during cooking;
- g) Poor cleaning maintenance practice may compromise fire protection cladding or fire-rated access panels on ducts;
- h) Poor siting and/or maintenance (or absence) of fire suppression system;
- j) Unsuitable ductwork for kitchen environment;
- k) Poor cleaning maintenance practice may compromise fire protection cladding or fire-rated access panels on ducts;
- m) Level of competence of cleaning contractor;
- n) Lack of a capable person on site, human error; and
- p) Lack of knowledge about the extract ventilation.

4.6 Cooking Equipment

4.6.1 Approval of cooking equipment shall be based on one of the following criteria:

- a) Conforming to available Indian Standards.
- b) Such test results being acceptable to the local authorities.

4.6.2 *Installation*

4.6.2.1 All certified appliances shall be installed in accordance with the terms of their certificate of conformity and the manufacturer’s instructions.

4.6.2.2 Cooking appliances requiring protection shall not be moved, modified, or rearranged without prior re-evaluation of the fire-extinguishing system by the system installer or their authorized personnel, unless otherwise allowed by the design of the fire extinguishing system.

4.6.2.3 The fire extinguishing system shall not require re-evaluation where the cooking appliances are moved for the purposes of maintenance and cleaning, provided the appliances are restored to already approved design location prior to cooking operations, and any disconnected fire extinguishing system nozzles attached to the appliances are reconnected in accordance with the manufacturer’s certified design manual.

4.6.2.4 An acceptable procedure shall be followed that will ensure that the appliance is restored to an approved design location.

4.6.2.5 All deep fat fryers shall be installed with at least 450 mm space between the fryer and surface flames from adjacent cooking equipment.

4.6.2.6 Provision of **4.6.2.5** shall not apply where a steel or tempered glass baffle plate is installed at a minimum 200 mm in height between the fryer and surface flames of the adjacent appliance.

4.6.2.7 If the fryer and the surface flames are at different horizontal planes, the minimum height of 200 mm shall be measured from the higher of the two.

4.6.3 *Operating Controls*

Deep fat fryers shall be equipped with a separate high limit control in addition to the adjustable operating control (thermostat) to shut of fuel or energy when the fat temperature reaches 250 °C at 25 mm below the surface.

5 GENERAL REQUIREMENTS

5.1 Commercial cooking operations are defined as kitchens that have cooking equipment that produce grease and grease laden vapours. This includes flat grills, char broilers and deep fat fryers. The typical residential range (electric or gas) would not be considered a grease producing appliance. Other equipment, such as ovens, microwaves and steam kettles also fall into the non-grease producing appliance category. The following is information regarding two of the most common types of equipment that produce grease and/or grease laden vapours.

5.1.1 *Deep Fat Fryers*

Deep fat fryers are a major cause of kitchen fires. Oil can splash and easily come into contact with an open flame from an adjacent piece of cooking equipment, such as a gas-fired range top. A 450 mm clearance shall be maintained between the deep fat fryer and the open flame cooking equipment. The normal temperature range for food service frying is 160 °C to 190 °C. As the temperature of oil increases, so does the risk of an accidental grease fire. All deep fat fryers shall be equipped with a high temperature limiting device, which will shut off the fuel or energy in the event the cooking oil exceeds a temperature of 250 °C. It is strongly recommended to provide back-up devices also for limiting the temperature as mentioned above.

5.1.2 *Flat Grills/Griddles*

Flat grills and griddles are typically used for cooking foods that require flat, even cooking surface. When used for this type of cooking, grease and grease laden vapours will be produced. To adequately control the fire hazard associated with these types of cooking operations, two fire protection components shall be installed namely, a hood and ventilation system and an automatic extinguishing system.

5.1.3 *Hood and Ventilation System*

A kitchen hood and ventilation system will include an exhaust hood or canopy, ductwork, fan system, and a means of providing adequate make-up air. This system will effectively remove the heat, grease, and grease laden vapours from the cooking area. The hood and ventilation system shall be professionally installed according to relevant Indian Standards. Local fire officials shall also be consulted, for any additional requirements. The hood shall be equipped with the appropriate grease removal filters. Only baffle style filters complying with concerned standards shall be used in cooking operations so as to produce a moderate to heavy amount of grease. Mesh filters are not appropriate for commercial cooking operations. Filters shall be cleaned regularly to prevent the build-up of grease. Lighting units shall be equipped with tight fitting protective globe lights with steel enclosures that are mounted on the outer surface of the hood. All electrical equipment shall be installed in accordance with SP 30 by a licensed electrician.

5.1.4 *Clearance*

Where enclosures are not required, hoods, grease removal devices, exhaust fans, and ducts shall have a clearance of at least 450 mm for high combustible material, 80 mm for moderate combustible material, and 0 mm for non-combustible material.

5.1.5 *Clearance Reduction*

5.1.5.1 Where a clearance reduction system consisting of 0.35 mm sheet metal spaced out 25 mm on non-combustible spacers is provided, there shall be a minimum of 230 mm clearance to combustible material.

5.1.5.2 Where a clearance reduction system consisting of 0.75 mm sheet metal on 25 mm mineral wool or ceramic fibre blanket reinforced with wire mesh or equivalent spaced 25 mm on non-combustible spacers is provided, there shall be a minimum of 80 mm clearance to combustible material.

5.1.5.3 Zero clearance to moderate combustible materials may be permitted by authorities concerned where the latter are protected by metal lath and plaster, ceramic tile, quarry tile, other non-combustible materials or assembly of non-combustible materials, or materials and products that are certified by recognized agencies for the purpose of reducing clearance.

5.1.6 *Clearance Integrity*

5.1.6.1 In the event of damage, the material or product shall be repaired and restored to meet its intended conformity or clearance requirements and shall be acceptable to the authority having jurisdiction.

5.1.6.2 In the event of a fire within a kitchen exhaust system, the duct, and its enclosure (rated shaft, factory-built grease duct enclosure, or field-applied grease duct enclosure) shall be inspected by qualified personnel to determine whether the duct and protection method are structurally sound, capable of maintaining their fire protection function, and in compliance with this standard for continued operation.

5.1.6.3 Protection shall be provided on the wall from the bottom of the hood to the floor, or to the top of the non-combustible material extending to the floor, to the same level as required in **5.2.1**.

5.1.6.4 The protection methods for ducts to reduce clearance shall be applied to the combustible or limited-combustible construction, not to the duct itself.

5.2 Factory-Built and Field-Applied Grease Duct Enclosures

5.2.1 Field-applied grease duct enclosures shall be protected with a through penetration firestop system having a fire resistance rating of the assembly being penetrated. The firestops shall be tested as per IS 12458.

5.2.1.1 The surface of the field-fabricated grease duct shall be continuously covered on all sides from the point at which the duct enclosure penetrates a ceiling, wall, or floor to the outlet terminal.

5.2.1.2 The field-applied grease duct shall be certified by recognized agencies and installed in accordance with the manufacturer’s instructions and the listing requirements.

5.2.2 Where subject to physical damage, field-applied grease duct enclosures shall be protected as deemed necessary by the authority having jurisdiction.

5.2.3 Factory-built grease duct enclosures shall be protected with a through-penetration firestop having a fire resistance rating of the assembly being penetrated from the point at which the duct penetrates a ceiling, wall, or floor to the outlet terminal.

5.2.3.1 The factory-built grease duct protection system shall be certified by recognized agencies.

5.2.3.2 The factory-built grease duct protection system shall be installed in accordance with the manufacturer’s instructions and the certificate of conformity.

5.2.4 Field-applied grease duct enclosures and factory-built grease duct enclosures shall demonstrate that they provide mechanical and structural integrity, resiliency, and stability when subjected to expected building environmental conditions, duct movement under general operating conditions, and duct movement due to fire conditions.

5.2.5 The specifications of material, gauge, and construction of the duct used in the testing and listing of field-applied grease duct enclosures and factory-built grease duct enclosures shall be included as minimum requirements in their listing and installation documentation.

5.2.6 *Clearance Options for Field-Applied and Factory-Built Grease Duct Enclosures*

The following clearance options for which field-applied grease duct enclosures and factory-built grease duct enclosures have been successfully evaluated shall be clearly identified in their listing and installation documentation and on their labels:

a) Open combustible construction clearance at manufacturer’s requested dimensions;
b) Closed combustible construction clearance at manufacturer’s requested dimensions, with or without specified ventilation; and
c) Rated shaft clearance at manufacturer’s requested dimensions, with or without specified ventilation.

5.3 Building and Structural Duct Contact

5.3.1 A duct shall be permitted to contact non-combustible floors, interior walls, and other non-combustible structures or supports, but it shall not be in contact for more than 50 percent of its surface area for each 0.30 m of contact length.

5.3.2 Where duct contact shall exceed the requirements of **5.3.1**, the duct shall be protected from corrosion.

5.4 Duct Clearances to Enclosures

Clearances between the duct and interior surfaces of enclosures shall meet the requirements of **5.2**.

5.5 Drawings

A drawing(s) of the exhaust system installation along with copies of operating instructions for sub-assemblies and components used in the exhaust system, including electrical schematics, shall be kept on the premises.

5.6 Construction

5.6.1 The hood or that portion of a primary collection means designed for collecting cooking vapours and residues shall be constructed of and be supported by steel not less than 1.2 mm in thickness, stainless steel not less than 1.0 mm in thickness, or other approved material of equivalent strength and fire and corrosion resistance.

5.6.2 All seams, joints, and penetrations of the hood enclosure that direct and capture grease-laden vapours and exhaust gases shall have a liquid tight continuous external weld to the hood’s lower outermost perimeter.

5.6.3 Seams, joints, and penetrations of the hood shall be permitted to be internally welded, provided that the weld is formed smooth or ground smooth, so as to not trap grease, and is cleanable.

5.6.4 Internal hood joints, seams, filter support frames, and appurtenances attached inside the hood shall be sealed or otherwise made grease tight.

5.6.5 Penetrations shall be permitted to be sealed by devices that are certified for such use and whose presence does not detract from the structural integrity of hood or duct.

5.6.6 Certified exhaust hoods with or without exhaust dampers shall be permitted to be constructed of materials required by the listing.

5.6.7 Certified exhaust hoods with or without exhaust dampers shall be permitted to be assembled in accordance with the listing requirements.

5.6.8 *Eyebrow-Type Hoods*

5.6.8.1 Eyebrow-type hoods over gas or electric ovens shall be permitted to have a duct constructed from the oven flue(s) connected to the hood canopy up-stream of the exhaust plenum.

5.6.8.2 The duct connecting the oven flue(s) to the hood canopy shall be connected with a continuous weld or have duct-to-duct connection.

5.6.9 Insulation materials other than electrical insulation shall have a flame spread index of 25 or less. The flame spread index shall be determined as per the specialist literature.

NOTE — Specialist literature could be ASTM E84 ‘Standard Test Method for Surface Burning Characteristics of Building Materials’.

5.6.10 Adhesives or cements used in the installation of insulating materials shall comply with the requirements of **5.6.9** when tested with the specific insulating material.

5.6.11 Penetrations shall be sealed with certified devices in accordance with the requirements of devices that require penetration of the hood, such as pipe and conduit penetration fittings and fasteners, shall be certified by approved agencies.

5.6.12 Wall-mounted exhaust hood assemblies shall be tight fitting against the back wall so as to not permit passage of grease vapour behind the hood or between the back wall and the hood assembly.

5.6.13 *Hood Size*

Hoods shall be sized and configured to provide for the capture and removal of grease-laden vapours.

5.6.14 *Exhaust Hood Assemblies with Integrated Supply Air Plenums*

The construction and size of exhaust hood assemblies with integrated supply air plenums shall comply with the requirements of **5.3** and **5.4**. The construction of the outer shell or the inner exhaust shell shall comply with **5.3**. Where the outer shell is welded, the inner shell shall be of grease tight construction.

5.7 Fire Dampers

5.7.1 A fire-actuated damper shall be installed in the supply air plenum at each point where a supply air duct inlet or a supply air outlet penetrates the continuously welded shell of the assembly.

5.7.2 The fire damper shall be certified for such use or be part of a certified exhaust hood with or without exhaust damper.

5.7.3 The actuation device shall have a maximum temperature rating of 141 °C.

5.7.4 Supply air plenums that discharge air from the face rather than from the bottom or into the exhaust hood and that are isolated from the exhaust hood by the continuously welded shell extending to the lower outermost perimeter of the entire hood assembly shall not require a fire-actuated damper.

5.8 Grease Removal Devices

5.8.1 *General*

5.8.1.1 Certified grease filters, certified baffles, or other certified grease removal devices for use with commercial cooking equipment shall be provided.

5.8.1.2 Certified grease filters and grease removal devices that are removable but not an integral component of a specific certified exhaust hood shall be certified in accordance relevant standards.

5.8.1.3 Mesh filters shall not be used unless evaluated as an integral part of a certified exhaust hood or certified in conjunction with a primary filter in accordance relevant standards.

5.8.2 *Installation*

5.8.2.1 *Separation distance*

The distance between the grease removal device and the cooking surface shall be as great as possible but not less than 450 mm. Where grease removal devices are used in conjunction with charcoal or charcoal-type broilers, including gas or electrically heated char broilers, a minimum vertical distance of 1.25 m shall be maintained between the lower edge of the grease removal device and the cooking surface. For cooking equipment without exposed flame and where flue gases bypass grease removal devices, the minimum vertical distance shall be permitted to be reduced to not less than 150 mm. Grease removal devices supplied as part of certified hood assemblies shall be installed in accordance with the terms of the listing and the manufacturer's instructions.

5.8.3 *Grease Removal Device Protection*

5.8.3.1 Where the distance between the grease removal device and the appliance flue outlet (heat source) is less than 450 mm, grease removal devices shall be protected from combustion gas outlets and from direct flame impingement occurring during normal operation of cooking appliances producing high flue gas temperatures.

5.8.3.2 This protection shall be permitted to be accomplished by the installation of a steel or stainless-steel baffle plate between the heat source and the grease removal device. The baffle plate shall be sized and located so that flames or combustion gases travel a distance not less than 450 mm from the heat source to the grease removal device. The baffle shall be located not less than 150 mm from the grease removal devices.

5.8.4 *Grease Filters*

Grease filters shall be certified and constructed of steel or certified equivalent material. They shall be of rigid construction that will not distort or crush under normal operation, handling, and cleaning conditions. The filters shall be arranged so that all exhaust air passes through the grease filters. Grease filters shall be easily accessible and removable for cleaning. They shall be installed at an angle not less than 45° from the horizontal.

5.8.5 *Grease Drip Trays*

Grease filters shall be equipped with a grease drip tray beneath their lower edges. Grease drip trays shall be kept to the minimum size needed to collect grease. The trays shall be pitched to drain into an enclosed metal container having a capacity not exceeding 4 litres. Grease filters that require a specific orientation to drain grease shall be clearly so designated, or the hood shall be constructed so that filters cannot be installed in the wrong orientation.

5.9 Exhaust Systems

5.9.1 *General*

5.9.1.1 Ducts shall not pass-through fire walls. All ducts shall lead directly to the exterior of the building, so as not to unduly increase any fire hazard. Duct systems shall not be interconnected with any other building ventilation or exhaust system.

5.9.1.2 All ducts shall be installed without forming dips or traps that might collect residues. Also,

a) In manifold (common duct) systems, the lowest end of the main duct shall be connected flush on the bottom with the branch duct; and

b) Exhaust ducts used in downdraft appliance ventilation systems shall be allowed to include an upturn in the duct provided the trapped area contains a low point drain to an approved grease reservoir not exceeding 4 litres in capacity and the entire length of the duct is easily accessible for cleaning.

5.9.1.3 Openings required for accessibility shall comply with **5.9.3**. A sign stating the following shall be placed on all access panels:

ACCESS PANEL
(DO NOT OBSTRUCT)

5.9.1.4 Certified grease ducts shall be installed in accordance with the terms of the certificate of conformity and the manufacturer's instructions.

5.9.2 *Clearance*

5.9.2.1 Clearance between ducts and combustible materials shall be provided in accordance with the requirements of **5.2.6**.

5.9.2.2 Where single-wall ductwork penetrates a non-fire-rated roof assembly, the penetration point shall be of limited-combustible or non-combustible construction unless a field-applied grease duct enclosure is installed to the top of the roof kerb or the clearances of **5.2.6** are maintained.

5.9.3 *Openings*

Openings shall be provided at the sides or at the top of the duct, whichever is more accessible, and at changes of direction. The openings shall be protected by approved access constructed and installed in accordance with the requirements of **5.10**. Openings shall not be required in portions of the duct that are accessible from the duct entry or discharge. For hoods with dampers in the exhaust or supply collar, an access panel for cleaning and inspection shall be provided in the duct or the hood within 450 mm of the damper. For common exhaust duct systems, access panel openings shall be provided for installation and servicing of the fire-extinguishing system. The access panel openings shall not be required in portions of the common exhaust duct or branch duct that are accessible from the branch duct connection to the exhaust hood. Exhaust fans with ductwork connected to both sides shall have access for cleaning and inspection within 1 m of each side of the fan.

5.9.4 *Openings in Ducts*

All openings shall comply with the following requirements:

5.9.4.1 *Horizontal ducts*

a) On horizontal ducts, at least one 500 mm × 500 mm opening shall be provided for personnel entry;
b) Where an opening of the size specified as above is not possible, openings large enough to permit thorough cleaning shall be provided at 3.7 m intervals;
c) If not easily accessible from a 3 m stepladder, openings on horizontal grease duct systems shall be provided with safe access and a work platform;
d) Support systems for horizontal grease duct systems 600 mm and larger in any cross-sectional dimension shall be designed for the weight of the ductwork plus 360 kg at any point in the duct systems; and
e) On non-certified ductwork, the edge of the opening shall not be less than 40 mm from all outside edges of the duct or welded seams.

5.9.4.2 *Vertical ducts*

a) On vertical ductwork where personnel entry is possible, access shall be provided at the top of the vertical riser to accommodate descent;
b) Where personnel entry is not possible, adequate access for cleaning shall be provided on each floor;
c) If not easily accessible from the floor or a 3 m stepladder, openings on vertical grease ducts shall be provided with safe access and a work platform; and
d) On non-certified ductwork, the edge of the opening shall not be less than 40 mm from all outside edges of the duct or welded seams.

5.9.4.3 *Access panels*

a) Access panels shall be of the same material and thickness as the duct;
b) Access panels shall have a gasket or sealant that is rated for 815 °C and shall be grease tight;
c) Fasteners, such as bolts, weld studs, latches, or wing nuts, used to secure the access panels shall be carbon steel or stainless steel and shall not penetrate duct walls; and
d) Certified grease duct access door assemblies (access panels) shall be installed in accordance with the terms of the listing and the manufacturer's instructions.

5.10 Protection of Openings

5.10.1 Openings for installation, servicing, and inspection of certified fire protection system devices and for duct cleaning shall be provided in ducts and enclosures shall conform to the requirements of **5.9.3**.

5.10.2 Enclosure openings required to reach access panels in the ductwork shall be large enough for removal of the access panel through the enclosure opening.

5.11 Other Grease Ducts

Other grease ducts shall comply with the following requirements:

5.11.1 *Materials*

Ducts shall be constructed of and supported by carbon steel not less than 1.6 mm in thickness or stainless steel not less than 1.2 mm in thickness. Factory-built grease ducts certified by approved agencies shall be permitted to use materials in accordance with their certificate of conformity.

5.11.2 *Installation*

All seams, joints, penetrations, and duct-to-hood collar connections shall have a liquid tight continuous external weld. Duct-to-hood collar connections shall not require a liquid tight continuous external weld. Penetrations shall be permitted to be sealed by other certified devices that are tested to be grease tight and are evaluated under the same conditions of fire severity as the hood or enclosure of certified grease extractors and whose presence does not detract from the structural integrity of hood or duct. Internal welding shall be permitted, provided the joint is formed ground smooth and is readily accessible for inspection. Penetrations shall be sealed with certified by recognized agencies. Devices that require penetration of the ductwork, such as pipe and conduit penetration fittings and fasteners, shall be certified by recognized agencies.

5.11.3 *Welded Duct Connections*

5.11.3.1 Duct-to-duct connection shall be one of the following:

a) Telescoping joint;
b) Bell-type joint;
c) Flange with edge weld; and
d) Flange with filled weld.

5.11.3.2 Butt-welded connections shall not be permitted.

5.11.3.3 For telescoping and bell-type connections, the inside duct section shall always be uphill of the outside duct section. The difference between the inside dimensions of overlapping sections in such connections shall not exceed 6 mm. For such connections, the over-lap shall not exceed 50 mm.

5.12 Exterior Installations

5.12.1 The exterior portion of the ductwork shall be vertical wherever possible and shall be installed and supported on the exterior of a building.

5.12.2 Bolts, screws, rivets, and other mechanical fasteners shall not penetrate duct walls.

5.12.3 Clearance of ducts shall comply with **5.2.6**.

5.12.4 All ducts shall be protected on the exterior by paint or other suitable weather-protective coating.

5.12.5 Ducts constructed of stainless steel shall not be required to have additional paint or weather-protective coatings.

5.12.6 Ductwork subject to corrosion shall have minimal contact with the building surface.

5.13 Interior Installations

5.13.1 *Duct Enclosures*

5.13.1.1 In all buildings where vertical fire barriers are penetrated, the ducts shall be enclosed in a continuous enclosure extending from the first penetrated fire barrier and any subsequent fire barriers or concealed spaces to or through the exterior, to maintain the fire resistance rating of the highest fire barrier penetrated.

5.13.1.2 In all buildings more than one storey in height and in one storey buildings where the roof–ceiling assembly is required to have a fire resistance rating, the ducts shall be enclosed in a continuous enclosure extending from the lowest fire-rated ceiling or floor above the hood, through any concealed spaces, or through the roof, to maintain the integrity of the fire separations required by Part 4 of SP 7.

5.13.1.3 The enclosure shall be sealed around the duct at the point of penetration of the first fire-rated barrier after the hood, to maintain the fire resistance rating of the enclosure.

5.13.1.4 The enclosure shall be vented to the exterior of the building through weather-protected openings.

5.13.1.5 The continuous enclosure provisions shall not be required where a field-applied grease duct enclosure or a factory-built grease duct enclosure is protected with a certified duct-through-penetration protection system equivalent to the fire resistance rating of the assembly being penetrated and where the materials are installed in accordance with the conditions of the conformity and the manufacturer’s instructions and are acceptable to the authority having jurisdiction.

5.14 Rooftop Terminations

5.14.1 Rooftop terminations shall be arranged with or provided with the following:

a) A minimum of 3 m of horizontal clearance shall be maintained from the outlet to adjacent buildings, property lines, and air intakes;

b) A minimum of 1.5 m of horizontal clearance shall be maintained from the outlet (fan housing) to any combustible structure;

c) A vertical separation of 1 m below any exhaust outlets for air intakes shall be maintained within 3 m of the exhaust outlet;

d) The ability to drain grease out of any traps or low points formed in the fan or duct near the termination of the system into a collection container that is non-combustible, closed, rainproof, and structurally sound for the service to which it is applied and that will not sustain combustion;

e) A grease collection device that is applied to exhaust systems that does not inhibit the performance of any fan;

f) Certified grease collection systems that meet the requirements of (d) and (e) above;

g) A certified grease duct complying with **5.3** or ductwork complying with **5.4**;

h) A hinged up-blast fan supplied with flexible weatherproof electrical cable and service hold-open retainer to permit inspection and cleaning that is certified for commercial cooking equipment with the following conditions:

    1) Where the fan attaches to the ductwork, the ductwork shall be a minimum of 450 mm away from any roof surface; and

    2) The fan shall discharge a minimum of 1 m away from any roof surface.

j) Other approved fan, provided it satisfies both of the following:

    1) The fan meets the requirements of (c) above and **5.15**; and

    2) Its discharge or its extended duct discharge meets the requirements of **5.14.1** (h) (2) (*see* also **5.15**).

5.14.2 Fans shall be provided with safe access and a work surface for inspection and cleaning.

5.14.3 *Wall Terminations*

Wall terminations shall be arranged with or provided with the following properties:

a) Through a non-combustible wall with a minimum of 3 m of clearance from the outlet to adjacent buildings, property lines, grade level, combustible construction, electrical equipment, or lines, and with the closest point of any air intake or operable door or window at or below the plane of the exhaust termination;

b) The closest point of any air intake or operable door or window above the plane of the exhaust termination shall be a minimum of 3 m in distance, plus 80 mm for each 1 degree from horizontal, the angle of degree being measured from the centre of the exhaust termination to the centre of the air intake or operable door or window;

c) A wall termination in a secured area shall be permitted to be at a lower height above grade if acceptable to the authority having jurisdiction;

d) The exhaust flow directed perpendicularly outward from the wall face or upward;

e) All the ductwork pitched to drain the grease back into the hood(s) or with a drain provided to bring the grease back into a container within the building or into a remote grease trap;

f) A certified grease duct complying with **5.15** or other ducts complying with **5.11**; and

g) An approved fan, provided it meets the requirements of **5.15**.

5.14.4 *Rooftop Terminations through Combustible or Limited-Combustible Walls*

5.14.4.1 Ductwork that exits a building through a combustible or limited-combustible wall to terminate above the roof line shall have wall protection provided in accordance with **5.2.6**.

5.14.4.2 Where the ductwork exits the building, the opening shall be sealed and shall include a weather-protected vented opening.

5.14.4.3 Where the ductwork exits through a rated wall, the penetration shall be protected in accordance with **5.11.2**.

5.15 Exhaust Fans

5.15.1 *Up-blast Exhaust Fans*

5.15.1.1 Approved up-blast fans with motors surrounded by the airstream shall be hinged, supplied with flexible weatherproof electrical cable and service hold-open retainers, and certified for this use. Their Installation shall conform to the requirements of **5.12** and **5.13**. Up-blast fans shall have a drain directed to a readily accessible and visible grease receptacle not to exceed 4 litres.

5.15.1.2 Up-blast fans shall be supplied with an access opening of a minimum 80 mm × 125 mm or a circular diameter of 100 mm on the curvature of the outer fan housing to allow for cleaning and inspection of the fan blades.

5.15.1.3 On existing up-blast fans where sufficient access is not available to allow for the removal of grease contamination, an approved hinge mechanism or access panel shall be installed.

5.15.2 *In-line Exhaust Fans*

In-line fans shall be of the type with the motor located outside the airstream and with belts and pulleys protected from the airstream by a grease tight housing. Such fans shall be connected to the exhaust duct by flanges securely bolted. Flexible connectors shall not be used. If the design or positioning of the fan allows grease to be trapped, a drain directed to a readily accessible and visible grease receptacle not exceeding 4 litres shall be provided. In-line exhaust fans shall be located in easily accessible areas of adequate size to allow for service or removal. Where the duct system connected to the fan is in an enclosure, the space or room in which the exhaust fan is located shall have the same fire resistance rating as the enclosure.

5.15.3 *Utility Set Exhaust Fans*

Utility set exhaust fans, if installed at the rooftop termination point, shall meet the requirements of **5.14**. Fans installed within the building shall be located in an accessible area of adequate size to allow for service or removal. Where the duct system connected to the fan is in an enclosure, the space or room in which the exhaust fan is located shall have the same fire resistance rating as the enclosure. The fan shall be connected to the exhaust duct by flanges securely bolted or by a system specifically certified for such use. Flexible connectors shall not be used. Exhaust fans shall have a drain directed to a readily accessible and visible grease receptacle not to exceed 4 litres.

5.16 Exhaust Fan Housings

Exhaust fan housings shall be constructed of carbon steel not less than 1.6 mm in thickness, of stainless steel not less than 1.2 mm in thickness, or, if certified, in accordance with the relevant standards.

5.17 Openings for Cleaning, Servicing, and Inspection

5.17.1 Openings for cleaning, servicing, and inspection shall conform to the requirements of **5.9.3** and **5.9.4**.

5.17.2 Clearances shall conform to the requirements of **5.1.4** or, if installed within an enclosure, to the requirements of **5.13**.

5.18 Airflow

5.18.1 *Air Velocity*

5.18.1.1 The air velocity through any duct shall not be less than 150 m/min.

5.18.1.2 Transition duct sections that do not exceed 1 m in length and do not contain grease traps shall be permitted to be connected to hoods and exhaust fans that do not meet this velocity.

5.19 Air Volume

5.19.1 Exhaust air volumes for hoods shall be of a sufficient level to provide for capture and removal of grease-laden cooking vapours.

5.19.2 Test data, performance tests acceptable to the authority having jurisdiction, or both shall be displayed, provided on request, or both.

5.19.3 Lower exhaust air volumes shall be permitted during no-load cooking conditions provided they are sufficient to capture and remove flue gases and residual vapours from cooking equipment.

5.20 Exhaust Fan Operation

5.20.1 A hood exhaust fan(s) shall continue to operate after the extinguishing system has been activated unless fan shutdown is required by a certified component of the ventilation system or by the design of the extinguishing system.

5.20.2 The hood exhaust fan shall not be required to start upon activation of the extinguishing system if the exhaust fan and all cooking equipment served by the fan have been shut down.

5.21 Replacement Air

5.21.1 Replacement air quantity shall be adequate to prevent negative pressures in the commercial cooking area(s) from exceeding 5 Pa.

5.21.2 When the fire-extinguishing system activates, makeup air supplied internally to a hood shall be shut off.

5.22 Common Duct (Manifold) Systems

5.22.1 Master kitchen exhaust ducts that serve multiple tenants shall include provision to bleed air from outdoors or from adjacent spaces into the master exhaust duct where required to maintain the necessary minimum air velocity in the master exhaust duct.

5.22.2 Bleed air ducts shall connect to the top or side of the master exhaust duct.

5.22.3 The bleed air duct shall have a fire damper at least 300 mm from the exhaust duct connection.

5.22.4 The bleed air duct shall have the same construction and clearance requirements as the main exhaust duct from the connection to the exhaust duct to at least 30 mm on both sides of the fire damper.

5.22.5 Each bleed air duct shall have a means of adjusting (for example, by using volume dampers) the bleed air quantity.

5.22.6 Means to adjust the bleed air quantity shall be installed between the fire damper and the source of bleed air.

5.22.7 A bleed air duct shall not be used for the exhaust of grease-laden vapours and shall be so labelled.

5.22.8 Unused tenant exhaust connections to the master exhaust duct that are not used as bleed air connections shall be disconnected and sealed at the main duct.

6 INSPECTION, TESTING AND MAINTENANCE OF EQUIPMENT

6.1 Operating Procedures

6.1.1 Exhaust systems shall be operated whenever cooking equipment is turned on.

6.1.2 Filter-equipped exhaust systems shall not be operated with filters removed.

6.1.3 Openings provided for replacing air exhausted through ventilating equipment shall not be restricted by covers, dampers, or any other means that would reduce the operating efficiency of the exhaust system.

6.1.4 Instructions for manually operating the fire extinguishing system shall be posted conspicuously in the kitchen and shall be reviewed with employees by the management.

6.1.5 Certified exhaust hoods shall be operated in accordance with the terms of their listings and the manufacturer’s instructions.

6.1.6 Cooking equipment shall not be operated while its fire-extinguishing system or exhaust system is non-operational or impaired. Where the fire extinguishing system or exhaust system is non-operational or impaired, the systems shall be tagged as non-compliant, and the owner or owner’s representative shall be notified in writing of the impairment.

6.1.7 Secondary filtration and pollution control equipment shall be operated in accordance with the terms of its listing and the manufacturer’s recommendations.

6.1.8 Inspection and maintenance of ‘other equipment’ shall be conducted by properly trained and qualified persons acceptable to the authority having jurisdiction at a frequency determined by the manufacturer’s instructions or certificate of conformity of equipment.

6.2 Inspection, Testing, and Maintenance of Fire-Extinguishing Systems

6.2.1 Maintenance of the fire-extinguishing systems and certified exhaust hoods containing a constant or fire-activated water system that is certified to extinguish a fire in the grease removal devices, hood exhaust plenums, and exhaust ducts shall be made by properly trained, qualified, and certified person(s) acceptable to the authority having jurisdiction at least every four months in case of starred hotels and six months in case of other hotels.

6.2.2 All actuation and control components, including remote manual pull stations, mechanical, pneumatic and electrical devices, detectors, and actuators, shall be tested for proper operation during the inspection in accordance with the manufacturer’s procedures.

6.2.3 The specific inspection and maintenance requirements of the extinguishing system standards as well as the applicable installation and maintenance manuals for the certified system and service bulletins shall be followed.

6.2.4 Fusible links of the metal alloy type and automatic sprinklers of the metal alloy type shall be replaced at least semi-annually except as **6.2.7**.

6.2.5 The year of manufacture and the date of installation of the fusible links shall be marked on the system inspection tag.

6.2.5.1 The tag shall be signed or initialled by the installer.

6.2.5.2 The fusible links shall be destroyed when removed.

6.2.6 Detection devices, bulb-type automatic sprinklers and fusible links other than the metal alloy type (*see* IS 9972) shall be examined and cleaned or replaced annually.

6.2.7 Fixed temperature-sensing elements other than the fusible metal alloy type shall be permitted to remain continuously in service, provided they are inspected and cleaned or replaced, if necessary, in accordance with the manufacturer’s instructions, every twelve months or more frequently to ensure proper operation of the system.

6.2.8 Where required, certificates of inspection and maintenance shall be forwarded to the authority having jurisdiction.

6.3 Inspection of Fire Dampers

6.3.1 Actuation components for fire dampers shall be inspected for proper operation in accordance with the manufacturer's certified procedures.

6.3.2 *Replacement of Fusible Links*

Fusible links on fire damper assemblies shall be replaced at least semi-annually or more frequently as necessary. Replacement shall be made by a certified person acceptable to the authority having jurisdiction.

6.4 Documentation Tag

The year of manufacture and the date of installation of the fusible links shall be documented. The tag shall be signed or initialled by the installer.

6.5 Inspection for Grease Build-up

The entire exhaust system shall be inspected for grease build-up by a properly trained, qualified, and certified person(s) acceptable to the authority having jurisdiction and in accordance with Table 1.

Table 1 Schedule of Inspection for Grease Build-up

(*Clause* 6.5)

Sl No. (1)	Type or Volume of Cooking (2)	Inspection Frequency (3)
i)	Systems serving solid fuel cooking operations	Monthly
ii)	Systems serving high-volume cooking operations, such as 24 h cooking, charbroiling, or wok cooking	Quarterly
iii)	Systems serving moderate-volume cooking operations	Semi-annually
iv)	Systems serving low-volume cooking operations such as day camps, seasonal businesses, or senior centres	Annually

6.6 Inspection, testing, and maintenance of certified hoods containing mechanical or fire-actuated dampers, internal washing components, or other mechanically operated devices shall be inspected and tested by properly trained, qualified, and certified persons acceptable to the authority having jurisdiction every 4 months or at frequencies recommended by the manufacturer in accordance with their certificate of conformity.

6.7 Cleaning of Exhaust Systems

6.7.1 Upon inspection, if the exhaust system is found to be contaminated with deposits from grease-laden vapours, the contaminated portions of the exhaust system shall be cleaned by a properly trained, qualified, and certified person(s) acceptable to the authority having jurisdiction.

6.7.2 Hoods, grease removal devices, fans, ducts, and other appurtenances shall be cleaned to remove combustible contaminants prior to surfaces becoming heavily contaminated with grease or oily sludge.

6.7.3 At the start of the cleaning process, electrical switches that could be activated accidentally shall be locked out.

6.7.4 Fire-extinguishing systems including their components shall not be rendered inoperable during the cleaning process or maintenance thereof unless such work is carried out by a trained technician(s) acceptable to authority having jurisdiction. Adequate care shall be taken to prevent accidental discharge of the system during cleaning/maintenance or testing.

6.7.5 Flammable solvents or other flammable cleaning aids shall not be used.

6.7.6 Cleaning chemicals shall not be applied on fusible links or other detection devices of the automatic extinguishing system.

6.7.7 After the exhaust system is cleaned, it shall not be coated with powder or other substance.

6.7.8 When cleaning procedures are completed, all access panels (doors) and cover plates shall be restored to their normal operational condition.

6.7.9 When an access panel is removed, a service company label or tag pre-printed with the name of the company and giving the date of inspection or cleaning shall be affixed near the affected access panels.

6.7.10 Dampers and diffusers shall be positioned for proper airflow.

6.7.11 When cleaning procedures are completed, all electrical switches and system components shall be returned to an operable state.

6.7.12 When an exhaust cleaning service is used, a certificate showing the name of the servicing company, the name of the person performing the work, and the date of inspection or cleaning shall be maintained on the premises.

6.7.13 After cleaning or inspection is completed, the exhaust cleaning company and the person performing the work at the location shall provide the owner of the system with a written report that also specifies areas that were inaccessible or not cleaned.

6.7.14 Where required, certificates of inspection and cleaning and reports of areas not cleaned shall be submitted to the authority having jurisdiction.

6.8 Cooking Equipment Maintenance

6.8.1 Inspection and servicing of the cooking equipment shall be made at least annually by properly trained and qualified persons acceptable to the authority having jurisdiction.

6.8.2 Cooking equipment that collects grease below the surface, behind the equipment, or in cooking equipment flue gas exhaust, such as griddles or char broilers, shall be inspected and, if found with grease accumulation, cleaned by a properly trained, qualified, and certified person acceptable to the authority having jurisdiction.

7 FIRE SAFETY REQUIREMENTS

7.1 General

An automatic fixed suppression system shall be installed to protect all cooking equipment producing grease laden vapours and that might be a source of ignition of grease in the hood, grease removal device. Fire-suppression equipment shall be provided for the protection of grease removal devices, hood exhaust plenums, and exhaust duct systems. Once a fire has propagated to the hood and duct, fire suppression is absolutely necessary to protect the building and its occupants. All fire suppression systems and components installed shall be in accordance with respective Indian Standards as indicated in **7.2.1**.

7.2 Cooking Equipment (General)

Cooking equipment shall be protected with:

a) wet chemical suppression system;
b) automatic sprinkler system (not in the vicinity of cooking areas or inside hoods/ducts) (*see* IS 15105); and
c) other equivalent systems like water mist applications (*see* IS 15519) for kitchen fires.

7.2.1 *Fire Suppression Systems*

a) Wet chemical fire-extinguishing systems and components thereof used in cooking operations shall be in accordance with respective applicable Indian Standards as indicated in Annex A; and
b) Various fire suppression systems like sprinklers, water mist, foam, etc shall be in accordance with respective applicable standards as indicated in Annex A.

7.2.1.1 Hazards and equipment that can be protected using wet chemical extinguishing systems shall include the following:

a) Restaurant, commercial, and institutional hoods;
b) Plenums, ducts, and filters with their associated cooking appliances;
c) Special grease removal devices;
d) Odour control devices; and
e) Energy recovery devices installed in the exhaust system.

7.2.1.2 Manufacturer's design, installation, and maintenance manual shall be consulted for system limitations and applications for which wet chemical extinguishing systems for commercial cooking operations are considered satisfactory protection.

7.2.2 *Methodology*

7.2.2.1 Equipment certified or otherwise, that provides secondary filtration or air pollution control and that is installed in the path of travel of exhaust products shall be provided with an approved automatic fire suppression system, installed in accordance with the automatic fire suppression system manufacturer's instructions.

Exhaust products shall be provided with an approved automatic fire suppression system or installed in accordance with the automatic fire suppression system manufacturer's instructions.

7.2.2.2 Each protected cooking appliance, individual hood, and branch exhaust duct directly connected to the hood shall be protected by a system or systems designed and installed for simultaneous operation.

7.2.2.3 Where two or more hazards can be simultaneously involved in fire by reason of their proximity, the hazards shall be protected by either of the following:

a) Individual systems installed on each hazard to operate simultaneously; and
b) A single system designed and installed to protect all hazards that can be simultaneously involved.

7.2.2.4 Hoods installed end-to-end, back-to-back, or both, or sharing a common ductwork, and having a grease-producing appliance(s) located under one or more of the hoods shall be considered a single hazard area requiring simultaneous automatic fire protection in all hoods and ducts.

7.2.3 *System Actuation*

7.2.3.1 All systems shall have both automatic and manual methods of actuation.

7.2.3.2 The automatic and manual means of system actuation (exception for pneumatic tube detection), external to the control head or releasing device, shall be separate and independent of each other so that a failure of one will not impair the operation of the other.

7.2.3.3 When a certified releasing mechanism is used employing a single line for mechanical detection and remote manual control, the remote manual control shall be installed inline, prior to all detection devices, so malfunction of one does not impede operation of the other.

7.2.3.4 Automatic detection and system actuation shall be in accordance with the manufacturer's design, installation, and maintenance manual.

7.2.3.5 All devices necessary for proper operation of the system shall function simultaneously with the system operation.

7.2.3.6 Operation of any manual actuator shall be all that is required to bring about the full operation of the system.

7.2.3.7 At least one manual actuator shall be provided for each system.

7.2.3.8 All operating devices shall be designed, located, installed, or protected so that they are not subject to mechanical, environmental, or other conditions that could render them inoperative or cause inadvertent operation of the system.

7.2.3.9 An audible or visual indicator shall be provided to show that the system has operated, that personnel response is needed, and that the system is in need of recharge.

7.2.3.10 The extinguishing system shall be connected to the fire alarm system, if provided, in accordance with the requirements of IS 2189, so that the actuation of the extinguishing system will sound the fire alarm.

7.2.3.11 A readily accessible means for manual actuation shall be located in the path of egress. When manual actuation is used for cooking related protection, the manual actuation device shall be installed no more than 1 200 mm and no less than 1 050 mm above the floor. The manual actuation device shall clearly identify the hazard protected.

7.2.3.12 At least one manual actuation device shall be located as directed by the authority having jurisdiction, within the limitations of the manufacturer's design, installation, and maintenance manual.

7.2.3.13 Automatic systems protecting only common exhaust ducts shall not require a manual actuator.

7.2.3.14 The means for manual actuation shall be mechanical and shall not rely on electrical power for actuation.

7.2.3.15 Electrical power shall be permitted to be used for manual actuation if electrical supervision and a reserve power supply are provided (*see* **3.4.6.2** of Part 4 of SP 7).

7.2.3.16 These kitchen hoods independent suppression systems shall discharge wet chemicals to all areas of a kitchen range extract hood that is potentially coated in grease. The system shall also discharge over deep fat cooking pans or other potential fire source. The system can be activated by detectors above the appliances and in the entrance of the duct. Additional detector behind equipment in the duct may be necessary or fusible links, or manually by an actuation device easily accessible in the path of egress.

7.2.3.17 The following shall be the operational sequence:

a) Upon actuation of fire suppression system, any power or gas supplies serving the kitchen equipment shall be cut-off and isolated;
b) The fire suppression agent shall be automatically released to the hood filter and into the connecting ductwork and over kitchen appliances;
c) The exhaust fan shall not stop and continue operating, even after activation of the system; and the supply fan shall be cut off;
d) Detectors of appropriate types shall also be provided behind filters and over deep fat fryers but shall be carefully set to prevent false alarm from cooking that use flames;
e) Gas detectors shall be fitted to all kitchens that link to a gas solenoid valve for emergency shut off; and suitable gas detection system (based on type of gas used LPG or CNG) integrated with fire detection and alarm system shall be provided in addition to heat/multi detectors and sprinklers;
f) Manual shut off devices shall activate the fire suppression system, which in turn shall stop other systems like fuel supply, power supply, etc, this shall operate mechanically and not rely on electrical power for activation, unless this is from an emergency power source;
g) In the event of the kitchen hood system being activated, an alarm shall be sounded, the system shall be interfaced with the fire detection and alarm system; and
h) It is strongly recommended to provide remote monitoring for the health of kitchen fire safety equipment and interface the same with building management system.

7.2.4 *System Location*

7.2.4.1 Wet chemical containers and expellant gas assemblies shall be located within the temperature range specified in the manufacturer's design, installation, and maintenance manual.

7.2.4.2 If ambient temperatures outside the manufacturer's operating temperature range are expected, protection shall be provided to maintain the temperature within the certified range.

7.2.4.3 Wet chemical containers and expellant gas assemblies shall not be located where they could be subjected to mechanical, chemical, or other damage.

7.2.4.4 Where damage due to chemical or mechanical exposure is expected, protective devices such as enclosures or guards acceptable to the authority having jurisdiction shall be provided.

7.2.4.5 Wet chemical containers and expellant gas assemblies shall be accessible for inspection, maintenance, and recharge.

7.2.4.6 Wet chemical containers and expellant gas assemblies shall be located as per the manufacturer's limitations but not where they will be exposed to the fire.

7.2.4.7 *Discharge nozzles*

All discharge nozzles shall be located to minimize damage or misalignment and be within the limitations and constraints of the manufacturer's design, installation, and maintenance manual.

7.2.5 *Special Requirements*

7.2.5.1 Systems protecting two or more hoods or plenums, or both, that meet the requirements of **7.2.2.3** shall be installed to ensure the simultaneous operation of all systems protecting the hoods, plenums, and associated cooking appliances located below the hoods. Also:

a) The building owner(s) or the owner's agent shall be responsible for the protection of any common exhaust ducts used by more than one tenant;
b) The tenant shall be responsible for the protection of common exhaust duct(s) serving hoods located within the tenant's space and up to the point of connection to the building owner's common exhaust duct;
c) The tenant's common duct shall be considered a branch duct to the building owner's common duct;
d) At least one fusible link or heat detector shall be installed within each exhaust duct opening in accordance with the certificate of conformity;
e) A fusible link or heat detector shall be provided above each protected cooking appliance and in accordance with the extinguishing system manufacturer's design, installation, and maintenance manual; further:
    1) Fusible links or heat detectors located at or within 300 mm into the exhaust duct opening and above the protected appliance shall be permitted to meet the requirements of **7.2.5.1 (e)**; and
    2) A single certified detection device shall be permitted for more than one appliance when installed in accordance with the system's conformity criteria.
f) Where the pipe or other conduit penetrates a duct or hood, the penetration shall have a liquid tight continuous external weld or shall be sealed by a certified device.

7.2.5.2 *Protection of common exhaust duct*

The common exhaust ducts shall be protected by one of the following methods:

a) Simultaneous operation of all independent hood, duct, and appliance protection systems; and
b) Simultaneous operation of any hood, duct, and appliance protection system and the system(s) protecting the entire common exhaust duct:
    1) A fusible link or other mechanically operated heat detection device from the common duct fire-extinguishing system shall be located at each branch-duct to common-duct connection where electrical operation of the common duct fire extinguishing system does not meet the requirements of **7.3.1**; and
    2) Where a fusible link or mechanically operated heat detector is located at a branch-duct to common-duct connection, an access panel shall be installed in accordance with specialist literature like NFPA 96 may be referred. Necessary provisions should be made available to enable servicing of the detector where the detector is not accessible from the branch duct connection to the exhaust hood.

All sources of fuel or heat to appliances served by the common exhaust duct shall be shut down upon actuation of any protection system in accordance with **6.7.4**.

Ignition sources contained within any exhaust system shall be protected and have a separate detection system that is in accordance with the manufacturer's specifications and that is approved by the authority having jurisdiction. Either a common extinguishing system shall be provided to protect both the ignition source(s) contained within an exhaust system and the exhaust system itself, or separate extinguishing systems shall be provided to protect the exhaust system and the ignition sources which shall be arranged for simultaneous automatic operation upon actuation of any one of those systems. A secondary filtration or air pollution control unit, whether or not it includes an ignition source, shall be protected either with a separate automatic fire suppression system designed to operate simultaneously with the activation of the automatic fire suppression system protecting the ventilation hood(s) being served or with a single automatic fire suppression system that protects both the secondary filtration or air pollution control unit and the hood(s) being served.

Movable cooking equipment shall be provided with a means to ensure that it is correctly positioned in relation to the appliance discharge nozzle during cooking operations.

7.3 Automatic Sprinkler Installation

7.3.1 Due diligence shall be exercised before considering protection with sprinkler/water mist installation particularly for the protection of fryers. No sprinklers shall be provided within 5 m of cooking equipment and kitchen hoods. An audit and analysis will be required before installing sprinklers within commercial cooking areas. Area sensitive to sprinklers shall be omitted but these areas shall be protected with wet chemical suppression systems or other systems tested and approved by competent bodies for the type of protection. Water mist systems conforming to IS 15519, if approved for use for the type of application (that is, commercial cooking equipment) by fire tests carried out by approved laboratories, can also be considered. When sprinkler/ water mist suppression systems are used for fire protection, those systems shall be tested and approved by NABL approved laboratories.

7.3.2 *Requirements for Cooking Equipment*

In cooking areas protected by automatic sprinklers, additional sprinklers or automatic spray nozzles shall be provided to protect commercial-type cooking equipment and ventilation systems that are designed to carry away grease-laden vapours unless otherwise protected. The additional sprinklers or automatic spray nozzles shall be approved for specific application.

7.3.3 *Sprinklers and Automatic Spray Nozzles*

7.3.3.1 Unless the requirements of **7.3.3.2** are met, standard sprinklers or automatic spray nozzles shall be so located as to provide for the protection of exhaust ducts, hood exhaust duct collars, and hood exhaust plenum chambers.

7.3.3.2 Sprinklers or automatic spray nozzles in ducts, duct collars, and plenum chambers shall not be required where all cooking equipment is served by certified grease extractors.

7.3.3.3 Unless the requirements of **7.3.3.5** are met, standard sprinklers or automatic spray nozzles shall be so located as to provide for the protection of cooking equipment and cooking surfaces.

7.3.3.4 Hoods containing automatic fire-extinguishing systems are protected areas; however, these hoods can be considered as obstructions to overhead sprinkler systems and shall require floor coverage underneath in accordance with **9.12.3** of IS 15105.

7.3.3.5 Cooking equipment below hoods that contain automatic fire-extinguishing equipment is protected and shall not require protection from the overhead sprinkler system.

7.3.4 *Sprinkler and Automatic Spray Nozzle Location — Ducts*

7.3.4.1 Unless the requirements of **7.3.4.2** or **7.3.4.4** are met, exhaust ducts shall have one sprinkler or automatic spray nozzle located at the top of each vertical riser and at the midpoint of each offset.

7.3.4.2 Sprinklers or automatic spray nozzles shall not be required in a vertical riser located outside of a building, provided the riser does not expose combustible material or provided the interior of the building and the horizontal distance between the hood outlet and the vertical riser is at least 7.6 m.

7.3.4.3 Unless the requirements of **7.3.4.4** are met, horizontal exhaust ducts shall have sprinklers or automatic spray nozzle devices located on 3 m centres beginning no more than 1.5 m from the duct entrance.

7.3.4.4 Sprinklers or automatic spray nozzles shall be required in ducts.

7.3.4.5 A sprinkler(s) or an automatic spray nozzle(s) in exhaust ducts subject to freezing shall be properly protected against freezing by approved means.

7.3.5 *Sprinkler and Automatic Spray Nozzle Location — Duct Collar*

7.3.5.1 Each hood exhaust duct collar shall have one sprinkler or automatic spray nozzle located 25 mm minimum to 300 mm maximum above the point of duct collar connection in the hood plenum.

7.3.5.2 Hoods that have certified fire dampers located in the duct collar shall be protected with a sprinkler or automatic spray nozzle located on the discharge side of the damper and shall be so positioned as not to interfere with damper operation. If the damper is less than 100 mm into the duct from the duct collar, only duct nozzle or automatic spray nozzles are acceptable.

7.3.6 *Sprinkler and Automatic Spray Nozzle Location — Exhaust Plenum Chambers*

7.3.6.1 Hood exhaust plenum chambers shall have one sprinkler or automatic spray nozzle centred in each chamber not exceeding 3 m in length.

7.3.6.2 Plenum chambers greater than 3 m in length shall have two sprinklers or automatic spray nozzles evenly spaced, with the maximum distance between the two sprinklers not to exceed 3 m.

7.3.7 *Sprinkler and Automatic Spray Nozzle Temperature Ratings and Orifice Sizes*

7.3.7.1 Where the exposed temperature is expected to be 150 °C or less, sprinklers, or automatic spray nozzles being used in duct, duct collar, and plenum areas shall be of the extra high temperature classification (163 °C to 191 °C).

7.3.7.2 When use of a temperature-measuring device indicates temperatures above 150 °C, a sprinkler or automatic spray nozzle of higher classification shall be used.

7.3.7.3 Sprinklers or automatic spray nozzles being used in duct, duct collar, and plenum areas shall have orifice with K-factors not less than 21 and not more than 80.

7.3.7.4 Access shall be provided to all sprinklers or automatic spray nozzles for examination and replacement.

7.3.8 *Cooking Equipment*

7.3.8.1 General cooking equipment (such as deep fat fryers, ranges, griddles, and broilers) that is considered to be a source of ignition shall be protected in accordance with the provisions of **7.3.2**.

7.3.8.2 *Deep fat fryers*

A sprinkler or automatic spray nozzle used for protection of deep fat fryers shall be certified for that application. The position, arrangement, location, and water supply for each sprinkler or automatic spray nozzle shall be in accordance with its respective Indian Standard.

7.3.8.3 *Fuel and heat shutoff*

The operation of any cooking equipment sprinkler or automatic spray nozzle shall automatically shut off all sources of fuel and heat to all equipment requiring protection. Any gas appliance not requiring protection but located under ventilating equipment shall also be shut off. All shutdown devices shall be of the type that requires manual resetting prior to fuel or power being restored.

7.3.9 *Indicating Valves*

A certified indicating valve shall be installed in the water supply line to the sprinklers and spray nozzles protecting the cooking and ventilating system.

7.3.10 *Strainers*

A certified line strainer shall be installed in the main water supply preceding sprinklers or automatic spray nozzles having nominal K-factors smaller than K-40.

7.3.11 *Test Connection*

A system test connection shall be provided to verify proper operation of equipment specified in **7.3.8.3**.

7.3.12 *Sprinkler and Automatic Spray Nozzle Replacement*

7.3.12.1 Unless the requirements of **7.3.12.2** are met, sprinklers and automatic spray nozzles used for protecting commercial-type cooking equipment and ventilating systems shall be replaced annually.

7.3.12.2 Where automatic bulb-type sprinklers or spray nozzles are used and annual examination should show no build-up of grease or other material on the sprinklers or spray nozzles, such sprinklers and spray nozzles shall not be required to be replaced annually.

7.3.13 Sprinklers protecting commercial-type cooking equipment and ventilation systems shall be of the high or extra high–temperature classification as determined by use of a temperature-measuring device.

7.3.14 *Other Requirements*

7.3.14.1 An approved indicating valve shall be installed in the main water supply preceding sprinklers having nominal orifice sizes smaller than 9.5 mm.

7.3.14.2 A system test connection shall be provided to verify proper operation of equipment.

7.3.14.3 The kitchen hoods shall be provided with hot water spray nozzle system or steam system to ensure that after kitchen closes down the hood is cleaned with one of the systems mentioned above, so that grease stuck in the hoods can be safely drained out.

7.4 Fire Separation Requirements

7.4.1 Where a kitchen is required for the preparation of food and/or where 'open flame' cooking appliances are used and/or where fryers (with no open flames) are used, the kitchen shall be separated from other parts of the same building by compartment wall and floor having fire resistance of at least 120 min.

7.4.2 Food serving areas shall be fire separated from the kitchens/cooking areas by fire rated elements having a resistance of 120 min. Doors shall have fire resistance of 120 min (*see* IS 3614) rating and fitted with automatic self-closing device.

NOTE — If the kitchen area is protected by an approved fire suppression system, fire rating of fire door as stated above can be reduced to half an hour.

7.4.3 In the open type of kitchen cooking area and sitting area needs to be segregated by 120 min rated glass and such glass partitions shall be protected with window sprinklers.

7.4.4 Separation requirement for kitchen may be waived:

a) if all the cooking facilities in the kitchen are fitted with an approved suppression system; or

b) if the entire occupancy (kitchen and dining/serving area) is fire separated from other parts of the same building with all elements having fire resistance of at least 120 min.

7.4.5 Where the flue or duct passes through the compartment wall or floor, the flue or duct shall be encased by non-combustible construction and no damper shall be permitted to be installed in such flue or duct. Also, such flue or ductwork shall be clear from combustible materials by at least 450 mm, and from non-combustibles by at least 150 mm.

7.4.6 If the commercial kitchen/cooking area is situated in a building that is not sprinkler protected, the floor area of the kitchen/cooking area shall not exceed 150 m^2.

7.4.7 LPG cylinders provided for the ‘open flame’ cooking activities are not allowed to be located at the basement. As regards LPG cylinder storage, attention is drawn to IS 15493, IS 15497, IS 15501, IS 15505, IS 15506, IS 15517, IS 15525, and SP 7 (Part 9/Sec 4) for compliance requirements.

7.4.8 Kitchen occupancy (even if with electrical ovens) shall not be allowed below ground level under any circumstances.

7.4.9 It is advisable to locate the kitchen/cooking operations located on the external periphery of the building so that in the event of mechanical ventilation failure, it can be naturally ventilated.

7.4.10 Show kitchens, live kitchen with or without live counters are increasingly resorted to. As conditions may vary for different locations, suitable additional separation arrangements like fire/smoke curtains, fire doors (*see* IS 3614) and other types of passive protection shall be insisted by the authorities if required.

7.5 Other Requirements

7.5.1 Life safety and egress requirements shall be governed by the requirements under SP 7 (Part 4). In case any requirements under this standard differ from those under SP 7 (Part 4), the provisions of this standard shall take precedence.

7.5.2 Extinguishers in the vicinity of cooking area and the hoods shall be suitable for the type of fire (class F type).

7.5.3 Any penetrations to the outside of a hood, be either welded or fit with a sealing device (certified by approval bodies) to not allow cooking grease, oil to migrate to the outer portion of the hood. The fitment arrangements shall be approved by competent bodies. Gaskets for the panels shall be certified to withstand a temperature of 800 °C.

7.5.4 Grease strip shall be readily available for efficient and regular cleaning of concrete or paved floors of kitchen and restaurant and also the drainage areas.

7.5.5 Provision of cleaning of the kitchen exhaust every six months to ensure that the carbon soot accumulated in the exhaust duct is cleaned to avoid the chances of outbreak of fire.

ANNEX A

(*Clause* 2)

LIST OF REFERRED STANDARDS

IS No./Other Standard	*Title*
IS 2189 : 2008	Selection, installation and maintenance of automatic fire detection and alarm system (*fourth revision*)
IS 3614 : 2021	Fire doors and doorsets — Specification (*first revision*)
IS 8757 : 2021	Glossary of terms associated with fire safety (*second revision*)
IS 9972 : 2023	Automatic sprinkler heads for fire protection service (*first revision*)
IS 12458 : 2019	Fire resistance of through penetration firestops — Method of test (*first revision*)
IS 15105 : 2021	Design, installation and maintenance of fixed automatic sprinkler fire extinguishing systems (*first revision*)
IS 15493 : 2021	Gaseous fire extinguishing systems — General requirements (*first revision*)
IS 15497 : 2004	Gaseous fire extinguishing systems — IG 01 extinguishing systems
IS 15501 : 2004	Gaseous fire extinguishing systems — IG 541 extinguishing system
IS 15505 : 2004	Gaseous fire extinguishing systems — HCFC blend A extinguishing systems
IS 15506 : 2004	Gaseous fire extinguishing systems — IG 55 extinguishing systems
IS 15517 : 2004	Gaseous fire extinguishing systems — HFC 227ea (hepta fluoro propane) extinguishing systems
IS 15519 : 2020	Water mist fire protection systems — system design, installation and commissioning (*first revision*)
IS 15525 : 2004	Gaseous fire extinguishing systems — IG 100 extinguishing systems
IS 15683 : 2018	Portable fire extinguishers — Performance and construction (*first revision*)
SP 7 : 2016	National building code of India 2016
Part 4	Part 4: Fire and life safety
Part 9/Sec 4	Part 9: Plumbing services (including solid waste management), Section 4 Gas supply
SP 30 : 2023	National electrical code 2023 (*second revision*)

ANNEX B

(*Foreword*)

DETECTION TYPES AND ACTUATION UNITS

B-1 DETECTION

There are three types of detection:

a) *Mechanical detection* — Fusible links with melting metal elements or glass bulbs placed on a tensioned wire under hood, which are activated by heat, releases the tension wire, and activates the fire extinguishing system;

b) *Pressure detection* — Specially designed polyamide heat sensing tube or fusible plugs installed under the hood. In case of fire tube/ fusible plug will burst releasing the pressure and actuating the system; and

c) *Linear heat detection cable* (*LHDC*) — The LHDC consist of a heat-sensitive cable that can detect changes in temperature and trigger an alarm when a specific temperature threshold is reached. Optical fibre, pneumatic tube, and electric sensor cable are some instances of technology used in LHDC.

Selection of detection system type is dependent on the client’s requirements and technical conditions, that is, number and size of equipment under hood, number and location of air vents/ducts, hood’s length and shape, distance between hood and supply unit, kitchen working temperature (fryers, grills).

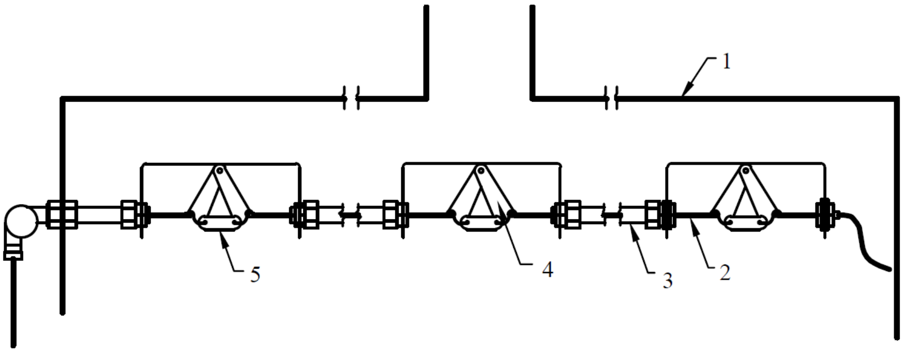
Fire detection provides signal actuating extinguishing system. There are four types of detection systems, depending on customer requirements, technical solutions etc:

B-1.2 Mechanical Detection System with Fusible Links or Heat Sensitive Glass Bulbs

After melting of the link or bursting of glass bulb sensor the wire gets loose, this causes actuation of the supply unit. The sensors are placed behind filters in critical locations. Fusible links are selected after measuring operational temperature under the hood in places where detectors will be placed. It is recommended to choose melting temperature of fusible links at least 30 °C higher than the measured temperature. This detection system can work with fusible links or heat sensitive glass bulbs. If detection bulbs are used it is required to clean thoroughly the kitchen from pieces of glass after the system actuation (*see* Fig. 1).

B-1.3 Pressure Fusible Plug Detection System

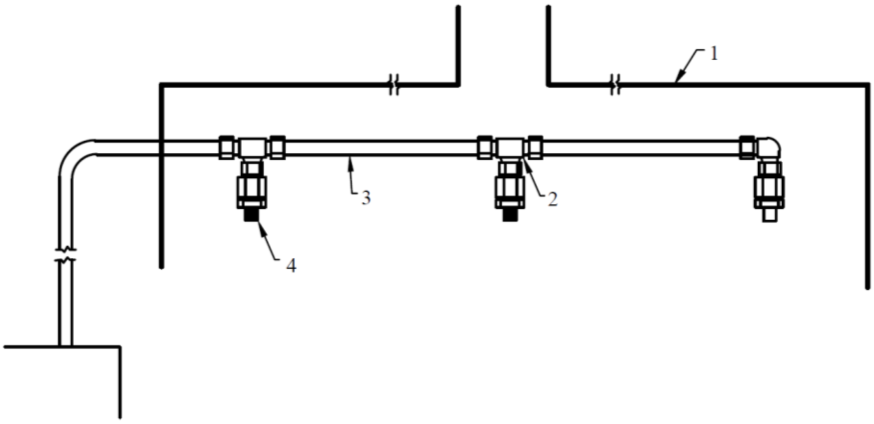
This detection system consists of piping under constant pressure, with fusible plugs mounted along its length. Melting of a plug causes pressure drop and actuation of the system. Selection method of the detectors is the same as for fusible links. Detectors are placed behind filters and in every ventilation duct (*see* Fig. 2).



Key

1	Kitchen hood
2	Wire
3	Wire casing
4	Scissors
5	Fusible link

FIG. 1 EXAMPLE OF MECHANICAL DETECTION SYSTEM WITH FUSIBLE LINKS



Key

1 Kitchen hood
2 Fittings
3 Steel tube
4 Fusible plugs

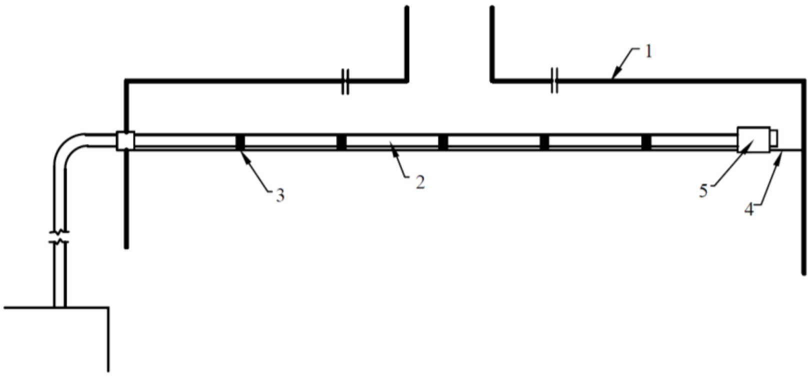
FIG. 2 FUSIBLE PLUG DETECTION SYSTEM

B-1.4 Pneumatic Polyamide Heat Sensing Tube Detection System

This system is based on specially designed polyamide pneumatic heat sensing tube, which melts at designated temperature causing pressure drop and actuation of the system. Pneumatic tube is placed behind filters (*see* Fig. 3).

B-1.5 Linear Heat Detection Cable — Digital Detection System

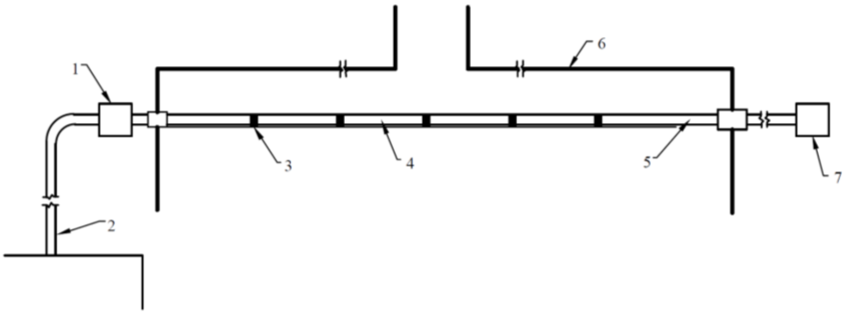
This detection is based on a special sensing cable – local temperature rise causes melting of insulation and closing of electric circuit. The resulting signal opens a small solenoid valve which provides pressure to the main pneumatic valve (*see* Fig. 4).



Key

1 Kitchen hood
2 Pressure detection tube
3 Cable tie
4 Wire supporting detection tube
5 Detection tube end (plug)

FIG. 3 PNEUMATIC TUBE DETECTION SYSTEM



Key

1 Interposing line enclosure
2 Connecting cable
3 Cable tie and piece of neoprene rubber between tie and table
4 Detection cable
5 Wire supporting detection cable
6 Hood
7 End of line enclosure

FIG. 4 DIGITAL DETECTION CABLE

B-2 ACTUATION UNITS

The task of the actuation units is to automatically (after receiving signal from detection) open the main valve. The system can be equipped with an actuation sensor, which can give a signal to an outside mechanism, such as alarm, gas cut-off valve etc. There is always a manual actuation button as well. Depending on the chosen detection system you may use different actuation unit. The systems are:

a) *Mechanical actuation unit with gas cartridge* — Used with fusible link detection. The mechanical actuation unit is used in conjunction with the fusible link detection system. Signal from the detection system is changed into a pneumatic signal (from the gas cartridge), which then opens the supply unit's main valve;

b) *Pneumatic actuation unit with auxiliary cylinder* — Used with pressure detection. Pneumatic actuation unit with pilot cylinder is used for pressure detection – fusible plug or pneumatic heat sensing tube detections. Pressure drop in the system opens the main valve;

c) *Indirect valve actuation unit* — Used with single cylinder supply units with pressure detection. Pressure drop in the system opens the valve; and

d) *Solenoid valve or valves with electric controlling* — Works with thermo-electric wire. While using linear heat detection system, an electrical signal from the detection cable opens the auxiliary solenoid valve, which causes pressure from the manifold to open the main pneumatic ball valve.

ANNEX C

(*Foreword*)

REQUIREMENTS AND TEST PROCEDURES FOR FIXED KITCHEN FIRE EXTINGUISHING SYSTEMS

C-0 This Annex identifies the evaluation and testing practices for the purposes of approval and certification of products based on evidence acceptable to NABL accredited labs. This Annex specifies the requirements and test procedures for approval of fixed fire extinguishing systems designed for the protection of kitchen equipment, such as deep fat fryers, other cooking appliances and extracts systems.

C-1 The objective of the approval procedure is to evaluate the effectiveness and reliability of a system in extinguishing fires in catering equipment, initiated in the cooking appliance. The evaluation of a system is essentially a verification of the parameters specified in the system manual and design.

C-2 FIRE EXTINGUISHMENT TESTS

C-2.1 Each type of cooking equipment must be tested separately for its unique fire hazard characteristics. The fire extinguishment tests are drawn up according to the general principle that the test conditions shall be those which give rise to the most onerous extinguishing situations for the system. One of the tests investigates the possibility of system discharge causing burning fat to splash out of the cooking appliance. As regards the choice of test cooking appliance, in order to minimise the number of fire tests, the deep fat fryer is selected to represent the range specified in the system manual.

C-2.2 Test Catering Equipment

a) The catering equipment used for the tests shall comprise a deep fat fryer and extract system (*see* Fig. 5); and

b) The dimensions and arrangement of the catering equipment shall be based on the system manual, according to the following criteria:

   1) The deep fat fryer pan shall have the maximum surface area that may be protected by one discharge nozzle;
   2) The deep fat fryer pan shall be marked with a maximum operating level which shall ensure an effective depth of cooking oil at least 150 mm;
   3) The width of the extract hood shall be the maximum that may be protected by one discharge nozzle. The length shall be based on the number of discharge nozzles that are to be sited in it, so that the maximum linear spacing for the nozzles is achieved;
   4) The extract ductwork shall have the maximum perimeter or diameter that may be protected by one nozzle;
   5) The length and arrangement of the extract system shall be as per Fig. 5;
   6) The deep fat fryer shall be placed directly beneath the entrance to the extract duct; and
   7) The vertical separation between the top surface of the deep fat fryer and the lowest surface of the extract hood shall not be greater than 1 m.

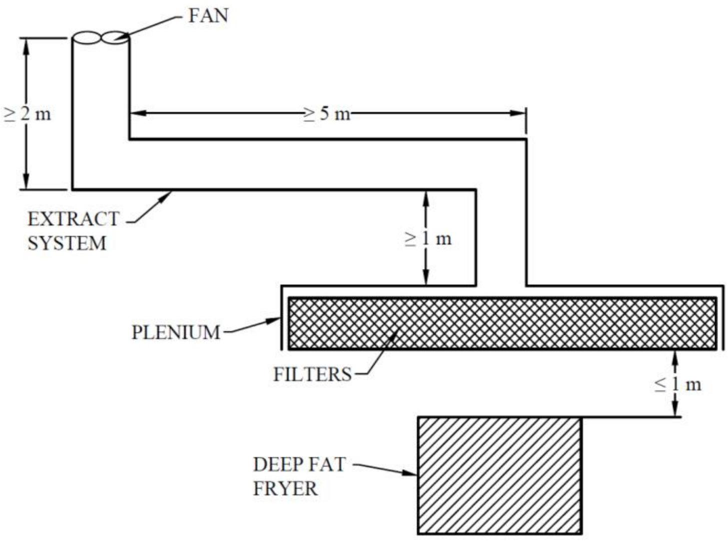


FIG. 5 TEST CATERING EQUIPMENT

C-2.3 Test System Designs

C-2.3.1 *Minimum Agent Flow Conditions Test*

The test shall be based on the system manual, according to the following criteria:

a) The system shall use the maximum number of discharge nozzles (or their equivalent in terms of agent discharge rate) for which it is designed;

b) The deep fat fryer protection nozzle shall be sited at the maximum height above the surface of the cooking oil;

c) The hood protection nozzles shall be sited at the maximum linear separation;

d) The discharge nozzles which are not placed to protect the deep fat fryer, hood and ductwork shall discharge to waste simulating protection of other appliances under the hood;

e) The manufacturer shall design the system such that the deep fat fryer protection nozzle is hydraulically the least favourable of the appliance protection nozzles. This shall be checked by the distribution test;

f) The maximum length and minimum diameter of agent supply piping shall be used;

g) The maximum number of branches and bends in the supply piping or the maximum equivalent length shall be used;

h) For stored pressure/gas cartridge type systems the minimum storage pressure of expellant and minimum charge of agent shall be used;

j) For pumped systems, the smallest diameter water supply pipe and minimum water supply pressure shall be used; and

k) For mechanical detection systems, the maximum length of line and maximum number of pulleys shall be used.

C-2.3.2 *Maximum Agent Flow Conditions Test*

The test shall be based on the system manual, according to the following criteria:

a) The system shall use the minimum number of discharge nozzles (or their equivalent in terms of agent discharge rate) that will protect the test catering equipment;

b) The deep fat fryer protection nozzle shall be sited at the minimum height above the surface of the cooking oil;

c) The minimum length and maximum diameter of agent supply piping shall be used;

d) The minimum number of branches and bends in the supply piping or the minimum equivalent length shall be used;

e) For stored pressure/gas cartridge type systems the maximum storage pressure of expellant and maximum charge of agent shall be used; and

f) For pumped systems, the maximum water supply pipe diameter with maximum water supply pressure shall be used.

C-2.4 Instrumentation

Thermocouples shall be placed in the following positions on each test set-up:

a) In the pan of the deep fat fryer, 50 mm below the surface of the cooking oil;

b) Centrally at the mid-point of the horizontal section of ductwork and at its exit; and

c) At the point where each detector is placed.

The thermocouples shall be monitored throughout the tests.

C-2.5 Test Procedures

C-2.5.1 *General*

A total of four separate fire extinguishment tests shall be carried out. Three tests shall employ the system designed to produce minimum agent flow conditions, the fourth shall employ the maximum agent flow conditions. The first test shall be carried out with maximum air-flow conditions through the extract system that is, with the extract fan operating and the filters removed from the hood. The second test is also conducted with the extract fan in operation, but with the filters fitted to investigate their influence on the development and extinguishment of the fire. For the third test, minimum air-flow conditions shall be achieved by having no forced ventilation and fitting the filters in the hood. The fourth test, using the maximum agent flow conditions, shall be carried out with no forced ventilation in operation and with the hood filters removed. This test may yield the most onerous conditions from the aspect of system discharge causing splashing of the burning fat. The test programme is given in Table 2.

Table 2 Test Programme
(*Clause* C-2.5.1)

Sl No.	Test	Agent Flow	Extractor Fan	Filters
(1)	(2)	(3)	(4)	(5)
i)	1	Minimum	On	Removed
ii)	2	Minimum	On	Fitted
iii)	3	Minimum	Off	Fitted
iv)	4	Maximum	Off	Removed

C-2.5.2 *Preparation*

The arrangement shall be prepared for each test as follows:

a) Specified areas of the interior surfaces of the hood and ductwork, the discharge nozzles and detectors shall be coated with an average of 1.5 kg/m^2 of solid unused cooking fat. This may be applied by means of spraying the heated fat onto the surface of the component to be prepared; and

b) The filters when fitted shall be evenly loaded with an average of 3 kg/m^2 of solid unused cooking fat, applied by means of spraying, dipping, or spreading the fat onto each filter.

The detection system shall be set up to operate as normal with the exception that it shall be prevented from actuating the system. Where more than one type of detection system may be used, each type shall be installed in at least one of the test systems.

C-2.5.3 *Method*

a) The fryer shall be filled with unused cooking oil to its maximum operating level;

b) The cooking oil shall be pure edible vegetable oil, with an auto ignition temperature range between 330 °C and 380 °C;

c) The heat source shall be applied to the cooking fat until auto-ignition occurs. The fire shall be allowed to develop with the heat source continuing to heat the fat;

d) The operation time of the detection system from auto-ignition shall be recorded;

e) 30 s after the operation of the detection system the system shall be manually actuated. Upon system actuation, observations shall be made of the shut-down of the heat source and where it is required, shut-down of the extract fan;

f) For stored pressure/gas cartridge type systems the discharge time for the system shall be recorded; and

g) For pumped systems, the discharge time shall be in accordance with the time specified in the system manual requirements.

C-2.5.4 *Requirements*

The following requirements shall be met in each test:

a) The fire shall be effectively extinguished within the system discharge time (as previously measured for stored pressure systems or as specified for pumped systems). One minute after the end of the agent discharge there shall be no residual flames burning in any part of the test catering equipment;

b) At the end of the system discharge, the temperatures recorded throughout the equipment shall be lower than those taken at the time of system actuation and below auto-ignition temperature of the cooking fat used;

c) No re-ignition of the fire in the catering equipment shall occur after discharge of the agent (to be checked for 10 min after the end of agent discharge);

d) No burning oil shall splash out of the cooking appliance as a result of agent discharge;

e) Actuation of the system shall cause shutdown of the heat source; and

f) Where it is a requirement of the system, manual actuation of the system shall cause shutdown of the extract fan.

C-3 DISTRIBUTION TESTS

The distribution tests are intended to investigate agent distribution balance in extremes of system design.

C-3.1 Single Container Systems

The test shall be carried out on the two systems designed to produce minimum and maximum agent flow conditions as described in the fire extinguishment tests. Each test may be conducted before a corresponding fire extinguishment test.

C-3.2 Procedure

A means of measuring and recording the agent discharge through each nozzle shall be set up. The system shall then be actuated by operation of a detector. The volume or weight of agent discharged through each nozzle shall be measured and recorded. The discharge time for the system shall be recorded.

C-4 COMPONENT EXAMINATION AND TESTS

Set out below are those testing methods which are applicable in assessing the reliability and suitability for use of the major components in a system. The test programme required for a particular system will depend greatly on its design and method of operation as described in the system manual.

C-4.1 Examination

Components submitted for test shall be examined visually on the following points prior to test:

a) Finished assembly identification markings, pressure strength and fill ratio (where applicable) shall be recorded; and
b) Comparison of specimens with manufacturer’s drawings for general form, completeness, capacities, and designated markings.

C-5 PRESSURE STRENGTH TESTS

Components shall be tested to and conform to the requirements of pressure and test pressure only as per relevant Indian Standards.

C-6 LEAKAGE TESTS

Components shall be tested to and conform to the requirements of IS 15683.

C-7 CORROSION TESTS

C-7.1 For stored pressure/gas cartridge type systems components shall be tested to and conform to the applicable requirements of IS 15683 for the applicable requirements are:

a) After operation, the pressure gauge if one is fitted, shall operate by subsequently indicating zero pressure;
b) There shall be no corrosion of the metal of the system likely to impair its operation or safety; and
c) There shall be neither visible signs of corrosion of the metal, nor detachment, cracking or bubbling of any protective coating of the body.

C-7.2 For pumped systems, components shall be tested to and conform to the internal corrosion test requirements of IS 15683. The system shall be subjected to flow tests before and after the internal corrosion test. The results of both flow tests shall be within ± 10 percent. Following the external corrosion test, there shall be no corrosion of the metal of the system likely to impair its operation or safety.

C-8 THERMAL SHOCK TEST

Glass bulb detectors shall not be damaged when tested.

C-9 CLOGGING TEST

For pumped flow systems components shall be tested to the requirements of the clogging test as per specialist literature. Flow tests shall be conducted before and after the clogging test, the flow rates of the before and after tests shall be within ± 10 percent of the first result.

NOTE — Special literature could be IMO 1165, 'Revised Guidelines for the Approval of Equivalent Water-Based Fire-Extinguishing Systems for Machinery Spaces and Cargo Pump-Rooms' by International Maritime Organization, particularly its **4.20**.

C-10 PUMP RUNNING TEST

For continuous flow systems, the pump shall be subjected to a continuous 10 h running test. For this test the system shall discharge for the 10 h duration, the water supply pressure shall be set to the minimum pressure specified in the system manual requirements.

ANNEX D

(*Foreword*)

COMMITTEE COMPOSITION

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